WE CLAIM:

A gas separation system for extracting a first gas fraction and a second gas fraction from a gas mixture including the first and second fractions, the gas separation system comprising:

a stator including a stator valve surface and a plurality of function compartments opening into the stator valve surface

a rotor rotatably coupled to the stator and including a rotor valve surface in communication with the stator valve surface, a plurality of flow paths for receiving adsorbent material therein, and a plurality of apertures provided in the rotor valve surface and in communication with the flow paths for cyclically exposing the flow paths to the function compartments; and

at least one surge absorber in communication with the stator for reducing pressure variations in the function compartments.

- 2. The gas separation system according to claim 1, wherein the surge absorber comprises a primary surge chamber in communication with one of the function compartments, the primary surge chamber including a port for coupling to compression machinery, a secondary surge chamber in communication with another one of the function compartments, and a first flow restrictor in communication with the primary and secondary surge chambers for facilitating pressure letdown between the compression machinery and the another function compartment.
- 3. The gas separation system according to claim 2, wherein the secondary surge chamber comprise a plurality of tertiary surge chambers in communication with respective ones of the function compartments, and a plurality of second flow restrictors each being in communication with adjacent ones of the tertiary surge chambers for maintaining each said function compartment at one of a plurality of discrete pressure levels.
- The gas separation system according to claim 2 or 3, wherein the compression machinery comprises one of a compressor, an expander, and a vacuum pump.
- 5. The gas separation system according to claim 2 or 3, wherein each said the flow restrictor comprises one of a fixed orifice, an adjustable throttle valve, and a pressure regulator.
- 6. The gas separation system according to claim 1, wherein the surge absorber comprises a plurality of parallel flow restriction channels, each said flow channel being coupled to a respective one of the function compartments and having a respective channel length for maintaining each said function compartment at one of a plurality of discrete pressure levels.
- 7. The gas separation system according to claim 6, wherein the surge absorber comprises a

plurality of parallel plates inclined relative to the function compartments, each said flow channel being defined between adjacent ones of the parallel plates.

- 8. The gas separation system according to claim 1, wherein the surge absorber comprises a surge chamber continually disposed in communication with a predetermined minimum number of the flow paths, the predetermined number of the flow paths defining an adsorbent volume, the surge absorber having a surge absorber volume at least equal to the adsorbent volume.
- 9. The gas separation system according to claim 8, wherein the surge absorber volume is at least twice the adsorbent volume.